Carolina North
MEETING REPORT
November 27-29, 2006

Monday, November 27th

11:00-2:00 Carolina North Planning

Participants

Karla Aghajanian	Ayers/Saint/Gross
Luanne Greene	Ayers/Saint/Gross (by phone)
Ellen Miller	SAI
George Alexiou	MAB
Luana Deans	MAB
Kevin Nunnery	Biohabitats
Ted Brown	Biohabitats
Keith Bowers	Biohabitats (by phone)
Brad Petterson	AEI
Jerry Schuett	AEI
Mike Walters	AEI
Tony Waldrop	VC RED
Jack Evans	UNC
Pat Crawford	UNC Office of General Counsel
Mary Jane Felgenhauer	UNC-FP
Neil Caudle	UNC/OVRED
Carolyn Elfland	Campus Services
Bruce Runberg	Facilities
Jonathan Howes	University Relations
Linda Convissor	University Relations
Tiffany Clarke	UNC
Jesse White	Economic and Business Development
Anna Wu	Facilities Planning

- ASG gave an overview of the workshop agenda and presentation for the plenary session.
- Overview of Ecological Assessment analysis mapping, process, and next steps
- Update from previous LAC meeting
- Update on Fiscal Impact Analysis
- Overview of USGBC GreenBuild conference by Peter Krawchyk and Cindy Shea

3:00-5:00 Infrastructure Workshop Kick-off Session

Participants

James Carnahan	LAC representative
Ed Holland	OWASA
Curtis Brooks	Town of Chapel Hill
Meg Holton	UNC-Energy Services (W, WW, SW)
Kirk Pelland	UNC-Grounds
Sharon Myers	UNC-EHS
Tom Bythell	UNC Grounds
Mary Jane Felgenhauer	UNC Facilities Planning
Pete Reinhardt	UNC EHS
Gary Shaver	UNC EHS
David Latowsky	TOCH Stormwater
Marty Pomerantz	UNC Rec Sports
Pat Crawford	UNC

Tiffany Clark	UNC
Rich Bell	Active Living by Design/UNC
Jack Evans	UNC
Ray Magyar	UNC-Public Safety
Claire Kane	UNC-Public Safety
Cheryl Stout	UNC-Public Safety
Jerry Schuett	AEI
William Lowery	UNC-Cogen Systems
Brad Petterson	AEI
Mike Walters	AEI
Brad Nies	BNIM Elements
Mohit Mehta	BNIM Elements
Cindy Shea	UNC-Sustainability
Blair Pollock	Orange County
John Masson	UNC-CN Facilities Planning
Jim McAdam	UNC-Energy Services
Warren Jochem	Sustainability
Phil Barner	Energy Services
Ellen Beckmann	DCHC MPO
David Bonk	Town of Chapel Hill
Mark Sobsey	UNC-Dept. ESE
Anna Wu	UNC-Facilities Planning
Ted Brown	Biohabitats
Kevin Nunnery	Biohabitats
Ellen Miller	Stonebridge Assoc.
George Alexiou	MAB
Luana Deans	MAB
Linda Convissor	University Relations
Jill Coleman	UNC-Facilities Planning
Karla Aghajanian	ASG
Luanne Greene	ASG
John d'Epagnier	RKK

- Group introductions
- Consultant team gave an overview of the project status and an overview of the summary from the previous workshop
- Consultants provided additional possibilities to consider during goals dialogue
- Questions/comments
- Presentation by James Carnahan about vertical planning
- Copies of the consultants' presentation and comments from the audience are available on the Carolina North website

Tuesday November 28th

8:30-11:30 Transportation, Parking, and Roads Work Group

Participants

David Bonk	Town of Chapel Hill
Dale McKeel	Town of Carrboro
Rich Bell	Active Living by Design
Kumar Neppalli	Town of Chapel Hill
Anna Biton	Town of Chapel Hill
Mike Taylor	Town of Chapel Hill
Jim Dunlop	NCDOT
Derek Poarch	UNC-DPS
Michael A. Pierce	UNC-Facilities Planning
Jonathan Howes	UNC-University Relations

Linda Convissor	UNC-University Relations
Carolyn W. Elfland	UNC-Campus Services
Cheryl Stout	UNC Public Safety
Mary Jane Felgenhauer	UNC-FP
Jim Alty	UNC-Facilities Services
Ray Magyar	UNC-Public Safety
Tiffany Clarke	UNC
Claire Kane	UNC-DPS
Sharon Myers	UNC-EHS
Bill McCraw	UNC FP
Jack Evans	UNC
Ellen Miller	SAI
Jill Coleman	UNC-FP
Luana Deans	MAB
Linda Convissor	University Relations
Dianne Bachman	UNC-FP
Bruce Runberg	UNC
Anna Wu	UNC
Ellen Beckmann	DCHC MPO
Karla Aghajanian	ASG
Luanne Greene	ASG
John d'Epagnier	RK&K
Keith Bowers	Biohabitats
Ted Brown	Biohabitats
Brad Nies	BNIM
Mohit Mehta	BNIM

Flip chart notes from session with additional comments

1. Who/when is land use being discussed? (David Bonk)
   - There does not appear to be one workgroup solely focusing on land use. Is it appropriate to discuss land uses in this workshop as transportation and land use are closely related?
   - There is not one forum for land use but rather every workgroup is discussing land use when relevant. Land use should be included as part of the discussion in this workshop.
2. Both land use and transportation are part of sustainability; by nature these elements may conflict with environmental/sustainable goals
3. How will the site be designed? Urban versus sub-urban (i.e. sprawl, separation of land uses)?
   a. Layout will influence peoples inclination to walk
   b. One element (i.e. transportation, building typology, water, ecological assessment, etc) will not dominate the design. Recognize conflicts between workgroups
4. Based on ecological assessment the "most developable" land is on the south side of the property
5. How will conflicts / trade-offs be addressed?
   a. Develop integrated view by the end of workshops
6. Should transportation drive the development design? (Jim Dunlop) Transportation supports land use. Design the site based on land use needs then develop the transportation system.
7. How closely will the mix of uses be integrated (i.e. proximity)? Will there be mix use buildings? Or will uses be separated? Research/education zone, residential zone, retail zone. Is it appropriate for this group to make recommendations?
8. Certain goals may be based on a set of presumptions
9. Provide/design for construction and delivery vehicles up front
10. Permanent strategy for service/delivery vehicles
11. Phase development around a nucleus to deal with construction traffic?
    a. This idea faces the following barriers:
       i. Time constraint
       ii. Technology may influence development

iii. Funding constraints

12. Flexibility to grow and/or re-use land and/or buildings for other uses as needs change. In phase I land may be needed for surface parking but then be replaced by a research building.
13. Economics influences level of transit
14. Provide for transit from the beginning
15. Recognize CH's transit corridors (2030 long range plan)
    a. No route for employees traveling to Carolina North from/to the northeast
16. CH does not plan to widen any roadways in the future
17. Currently it is faster to travel by bike versus transit and there is greater flexibility as users do not have to adhere to a bus schedule
18. Design CN and CH with safe bike facilities
19. Provide for complete streets: roads that serve all users to minimize vehicular speeds
20. Plan the transportation system and land uses to increasingly rely on non-SOV travel
21. Minimize need for others to travel to the CN site
22. Consider how people live (ex. desire to shop at lunch). Some people use their cars during the day or before/after work for personal reasons.
23. Consider how people work (ex. work related travel)
24. Different users have different travel needs
25. Incentives to decrease SOV travel
26. Be realistic about what land users will demand
    a. Example – Retailers need parking for customers
27. Be prepared to accept community/users response related to greater inconvenience if they need to give up their cars and use alternative transportation. Not everyone is happy to do so.
28. Challenge – Transit LOS in early phases may be lower. Early phases of Carolina North when there are fewer employees and therefore fewer transit riders, may not justify lower headways and substantial transit facilities.

11:45-3:45 Building Typology and Energy Generation & Consumption and Utilities Work Group

Participants

Gary Shaver	UNC-EHS
Peter Krawchyk	UNC-Facilities Planning
Meg Holton	Energy Services
Frost Rollins	TOCH
Carolyn Elfland	UNC
James Carnahan	Leadership Advisory Committee
Anna Wu	UNC-FP
Bruce Runberg	UNC-FP&C
Jim McAdam	UNC-Chilled Water
Phil Barner	UNC-Energy Services
John Masson	UNCCH-Facilities Planning
Ray DuBose	UNC-Energy Services
Cindy Shea	UNC-Sustainability
Linda Convissor	UNC-Chapel Hill
William Lowery	UNC-Cogen Systems
Jim Alty	UNC-Facilities Services
Edd Lovette	UNC-Building Services
Warren Jochem	UNC-Sustainability
Marty Pomerantz	UNC Rec Sports
Christopher Payne	UNC Housing
Jonathan Howes	UNC University Relations
Jack Evans	UNC
Mary Jane Felgenhauer	UNC-FP
John D'Epagnier	RK&K
Brad Petterson	AEI
Jerry Schuett	AEI
Mike Walters	AEI

Ted Brown	Biohabitats
Keith Bowers	Biohabitats
Luanne Greene	Ayers/Saint/Gross
Karla Aghajanian	Ayers/Saint/Gross

Flip chart notes from session

The notes captured on the flip charts during the Building Typology session are incorporated into the final Powerpoint slides that were shown during the Report Out session on 11/29. They are shown in bright green on the slides.

Notes from the Energy Generation, Consumption and Utilities Discussion

- Analog Displays need reference metric
- Look for building level solutions that could be integrated into larger campus level systems when possible (Photovoltaics, Microturbines, Fuel Cells) – Achieve the "Best of both Worlds"
- Challenge – Integration of private facilities into campus goals for energy / sustainability
- Systems reliability is a major issue that needs study on a building level and campus level. How many "9's" are required or will be expected.
- Consider reliability as a building type characteristic
- Goal setting dimensions → Sensitivity Analysis Criteria
    - -Cost
    - -Reliability
    - -Land Use
    - -Aesthetics
    - -Personal / Human Experience
    - -Actual Energy Conservation
    - -Supports the Program
    - -Operation & Maintenance
    - -Carbon Emission Reduction Potential
    - →Make assumptions for campus building makeup
    - →Building Energy Consumption Goals - Building Typology and Modeling needed for goal setting?
- CRED / Emissions
    - -AIA-2030: 60% reduction by 2010. "National Average" energy use data not yet available
    - -Meeting LEED <u>may</u> meet AIA 2030, 2010 goal.
    - -Beating ASHRAE 90.1 by 20-30% <u>may</u> meet AIA-2030 2015 to 2020 goals
    - -AEI to try to evaluate UNC Genomics Building relative to AIA-2030. (+/- 45% better than ASHRAE 90.1 with base building using aCV reheat system)
- Try to Incorporate Solar Technology
    - -Hot Water Generation
    - -Power Generation
    - -Morrison Dorm (40 year payback)
    - -Metrics?
    - ◦$/year dedicated to solar power? – No.
    - ◦% of Power provided by solar? – No.
- Renewable Energy Sources
    - -Why separate from solar? → not truly renewable like wind / solar / geothermal sources
    - -Black Box modeling to help develop scale models to help determine need for investments in renewable energy sources
    - -Need to develop problem diagram
    - -What % energy reductions / SF information is needed to help evaluate options

4:00-6:00 Ecological Assessment Faculty Methodological Review and Internal Review of Analysis

Participants

Robert Peete	UNC-Ecology
Johnny Randall	NC Botanical Garden
Jonathan Howes	UNC University Relations
Terri Buckner	citizen
Sharon Myers	UNC-EHS
Jack Evans	UNC
Mary Jane Felgenhauer	UNC-FP
Cindy Shea	UNC
Tony Waldrop	VC-RED
Pat Crawford	UNC Office of General Counsel
Neil Caudle	Office of VC-RED
Anna Wu	UNC FP
John D'Epagnier	RK&K
Ted Brown	Biohabitats
Keith Bowers	Biohabitats
Kevin Nunnery	Biohabitats
Luanne Greene	Ayers/Saint/Gross
Karla Aghajanian	Ayers/Saint/Gross
Brad Nies	BNIM
Mohit Mehta	BNIM

- Biohabitats gave an overview of the methodology for the Ecological Assessment and went through the inventory maps, attribute maps, and suitability analysis for an internal UNC group and professors and local scientists.
- The methodology for weighing/valuing the various attributes was discussed.

Wednesday November 8th

8:30-12:30 Landscape, Natural Habitat, Water Quality & Water, Wastewater, Stormwater Work Group

Participants

Meg Holton	UNC-Energy Services (W, WW, SW)
Ed Holland	OWASA
Sharon Myers	UNC-EHS
Fran DiGiano	UNC-ESE
Mark Sobsey	UNC-Dept. of Env. Science & Eng.
David Stancil	Orange County ERCD
Bruce Runberg	UNC-FP&C
David Larowsky	Chapel Hill Stormwater
Kirk Pelland	UNC Grounds
Ray DuBose	UNC-Energy Services
Mary Jane Felgenhauer	UNC-FP
Jill Coleman	UNC-Facilities Planning
Tom Bythell	UNC-Grounds
Anna Wu	UNC-FP
Jonathan Howes	UNC-University Relations
Jim McAdam	UNC-Chilled Water
Dianne Bachman	UNC-FP
Curtis Brooks	Town of Chapel Hill
Diane Gillis	UNC
Linda Convissor	UNC

John d'Epagnier	RKK
Terry Zentkovich	RKK
Kevin Nunnery	Biohabitats
Keith Bowers	Biohabitats
Ted Brown	Biohabitats
Karla Aghajanian	ASG
Luanne Greene	ASG
Ellen Miller	Stonebridge

Flip chart notes from session
Notes from the work group were incorporated into the final report-out slides that can be found on the Carolina North website.

2:00-4:00 Report out from Work Groups to Large Group & Wrap-up

Participants

Curtis Brooks	Town of Chapel Hill
Jill Coleman	UNC-FP
John Masson	UNC-CN Facilities Planning
Kirk Pelland	UNC-Grounds
Marty Pomerantz	Rec Sports
Warren Jochem	UNC Sustainability
Diane Gillis	UNC FP
Pat Crawford	UNC at Chapel Hill
Gary Shaver	UNC EHS
Jim McAdam	UNC-Energy Services
BJ Tipton	Office of Waste Reduction and Recycling, UNC
Francis DiGiano	UNC ESE
Cindy Shea	UNC-Sustainability
Tom Bythell	UNC-Grounds
Sharon Myers	UNC-EHS
Meg Holton	UNC-Energy Services (W, WW, SW)
Mike Taylor	TOCH Transportation
Anna Biton	Town of Chapel Hill
David Latowsky	Town of Chapel Hill
Bruce Runberg	UNC
Carolyn Elfland	UNC
Phil Barner	Energy Services
Anna Wu	UNC-FP
Claire Kane	UNC Transportation
Mary Jane Felgenhauer	UNC/FP
Jack Evans	UNC
Peter Krawchyk	UNC-Facilities Planning
Linda Convissor	University Relations
Luanne Greene	Ayers Saint Gross
Karla Aghajanian	Ayers Saint Gross
George Alexiou	MAB
John d'Epagnier	RK&K
Terry Zentokovich	RK&K
Jerry Schuett	AEI
Brad Petterson	AEI
Ted Brown	Biohabitats
Keith Bowers	Biohabitats
Brad Nies	BNIM Elements
Mohit Mehta	BNIM Elements
Ellen Miller	Stonebridge

- The consultants and the UNC Work Group leaders presented their summary goals for each work group and discussed how each of them related back to the Living Campus Concept:
- *A Living Campus is designed to provide all of its own operating needs and not burden other systems beyond its borders*
    - Operate a climate neutral campus
    - Restore native habitat
    - Plan based on resources
    - Treat buildings as species
    - Treat water as a valuable resource
    - Educate at every opportunity
    - Design for human health and productivity
    - Treat all wastewater on site
    - People and Planet friendly transportation
- The final Powerpoint slides from the plenary session are available on the Carolina North website.

DRAFT Landscape, Natural Habitat, and Water Quality Goals

- Create a space with more biodiversity than it has today.

- Understand and educate people that the CN campus will look different than the main campus, with an emphasis on providing and celebrating natural and native ecosystems that are integrated throughout the site.

- Identify existing site features that we want to celebrate, protect, and enhance and design for better access to experience their value.

- Integrate research, education, and outreach in both built and non-built conditions. Pursue these opportunities during planning, construction, and post-construction phases.

- Maintain/enhance community and ecosystem connectivity by preserving viewscapes, integrating ecological function throughout the built environment, and creating a natural and functional transition to the non-built environment. Provide for dedicated green space in the built environment.

- Restore disturbed ecological systems concurrent with development activities.
- Protect sensitive natural areas by thoughtful planning, design and maintenance of access around them.

- Protect, enhance and restore native soil properties to support indigenous plant growth, native soil fauna, enhance natural hydrologic process and support overall ecosystem function.

- Minimize erosion to protect habitat and reduce stress on natural water systems by preserving steep slopes in a natural, vegetated state.

- Replicate the natural, undisturbed hydrologic function of the land.
- Use native plant species for a healthy ecosystem that will conserve native wildlife, decrease the amount of water needed for landscape maintenance, reduce long-term maintenance, reduce soil erosion by production of long root systems, and protect water quality by controlling erosion and moderating floods and drought.

- Reduce the heat island effect by preserving forest patches, reforesting areas, and planting street, courtyard, and plaza trees.
- Build on existing disturbed areas before considering natural landscapes and allow natural site features to influence building siting and utility location.

- Plan for and design staging and stockpile areas associated with construction activities to avoid impacts to natural areas.

- Avoid disturbance to natural areas during construction and minimize disturbance in construction areas by providing tree protection and minimizing soil compaction.
- Quantify and understand the existing natural capital of the site to inform the planning process and associated conservation/development strategies.

- Plan for and design east-west access routes and paths across existing rail corridor and Seawell School Rd. Consider scenarios where rail line no longer exists or has been relocated.

- Maintenance of natural systems should be included as part of the site's operating budget. Maintenance of the natural systems should take an adaptive management approach.
- Employ environmentally sound maintenance practices to support biodiversity and protect at-risk ecosystems.

- Establish and sustain an active forest management program that considers harvesting of timber for use in site construction.

- Incorporate edible landscapes throughout developed areas.

- Identify and create community garden areas that provide a food source, social gathering place, and research opportunities.

DRAFT Water, Wastewater, Stormwater Goals

•Implement potable water conservation
•Separate potable water and reclaimed water infrastructure
•Maintain flexibility to treat wastewater on site
•Reclaim stormwater and wastewater
•Integrate research opportunities with regulatory and technology requirements
•Replicate natural hydrology within disturbed areas vs. undisturbed areas vs entire site
•Limit land disturbance
•Flexibility, Adaptability in Proven Innovative Systems
•Standardization of systems for each phase of development
•Develop O&M strategies for all systems
•Integration of design, operation & maintenance and intended use of spaces
•Consider energy efficiency of on-site systems
•Explore means to develop innovative mechanisms to fund innovative systems
•Develop redundancy / backup for innovative systems
•Explore alternate sources for potable water

DRAFT Transportation Goals

•Design Carolina North as a walkable community:
–Design the transportation system and development patterns (i.e., urban design elements such as density, building design, mix of uses, open space, etc.) to encourage self-propelled based transportation (walking, biking, etc.) as the primary means of travel and to promote a vibrant community
–Integrate on-site bike and pedestrian routes with existing and planned local facilities
–Design complete streets to minimize speeds, maximize peaceful coexistence of all modes, and minimize conflicts between pedestrian, bicycles and vehicles
–Create vehicle-free zones

Draft Transportation Goals

•Maximize use of transit at every phase of development:
–Design site to maximize opportunities to travel by transit from outset
–Design site for efficient transit movement as a priority element
–Focus most intensive development around transit nodes
–Identify, preserve and retrofit corridors for future transportation needs
–Reserve land for transit center
–Use rail corridor for high speed transit to extent feasible

•Minimize single-occupant vehicle use through policies, programs, and incentives:
–Apply travel demand management experience from Main Campus
–Promote greater use of strategies such as telecommuting and flexible work hours
–Automate administrative processes to minimize travel within and between campuses
–Provide incentives for using alternative modes
–Provide services and amenities that minimize the need to leave site
–Provide strong connections to Main Campus
•Design each phase of Carolina North to be accessible, and to progressively reduce reliance on SOV use and on-site parking
•Provide minimum amount of needed parking
–Maximize use of satellite parking for those who choose to drive
–Minimize amount of impervious surface
–Maximize opportunities for shared use of parking
•Design site and individual phases to minimize impacts of construction traffic
•Design a delivery and servicing system that provides convenient access to each building while minimizing conflicts with other modes
•Design site and transportation system with the flexibility to adapt to a variety of future transportation scenarios
•Respect surrounding neighborhoods:
–Minimize undesirable transportation impacts
–Provide appropriate connections
•Develop a plan to address capital and recurring funding needs for transportation, particularly transit
•Partner with local, regional and state transportation agencies:
–Develop a phased transportation plan and improvements
–Develop regional transportation initiatives to encourage use of alternatives
- – Obtain and leverage funding for transportation improvements

DRAFT Building Typology Goals

- Respect local aesthetic vernacular
- Respect local resources for materiality
- Solar orientation will be optimized
- *Respect the topography of land and natural resources*
- Free resources will be utilized first
    - Sun for light and heat
    - Wind for cooling and ventilation
    - Rainwater *Non-potable and Potable*
- Passive solar strategies will be utilized
- External shading will be integrated
- Envelope design and skin treatments will be optimized
- Allow for integration of site appropriate renewable energy sources
- Design strategies will be applied based on building type
- Design strategies will be considered on a life-cycle cost basis, not first cost
- Exceed local energy and water codes

- Exceed Energy Policy Act (water)
- Exceed current ASHRAE 90.1
- Exceed current International Energy Conservation Code (IECC)
- Align with Architecture 2030 goals
- Synergistic building types will be grouped together providing for the excesses of one building type to provide for needs of another building type
- Group similar building functions into the same HVAC control zone so those areas can be scheduled separately (e.g. separate around-the-clock areas daytime areas)
- Living Buildings
    - Harvests all its own energy and water
    - Adapted to climate and site
    - Operates pollution free
    - Promotes health and well-being
    - Comprised of Integrated Systems
    - Is Beautiful
    - Educates and Integrates Users
    - Uses Post Occupancy Evaluation to inform its behavior
- Spaces for collaboration will be included into building programs
- Capture the potential functional uses for indoor and outdoor spaces
- Develop a plan to keep carbon in check at the start of programming
- Minimize energy consumption, slow depletion of fossil fuel reserves
- Use building integrated and campus wide renewable energy systems
- Purchase renewable energy credits or carbon offsets for non-renewable energy fuels used
- Utilize a cradle-to-cradle approach when specifying products and systems
- Align with Architecture 2030 goals when developing a building project
- Comply with CRED for lifestyle and policy decisions
- Use sustainable systems and technologies as learning labs integrated into the curriculum/ research
- Provide real time performance data to the building users on site and to the public at large via the world wide web
- Demonstrate developing technologies

- *Provide and maintain acceptable indoor air quality, which is defined as: "Air in which there are no known contaminants at harmful concentrations as determined by cognizant authorities and with which a substantial majority (80% or more) of the people do not express dissatisfaction." (ASHRAE 62)*

- *Monitor and avoid indoor air quality problems during renovation, demolition, and construction activities*

- *Provide occupants with operational control of lighting and HVAC systems whenever possible*

- *Produce environments that enhance human comfort, well-being, performance, and productivity by reducing sick time*
- Develop a commissioning plan and include a commissioning agent in the design process

- Verify that the building's energy *and water* related systems are installed, calibrated and perform according to the owner's projects requirements, basis of design, and construction documents

- Provide easy access to user's manuals and continuing education for proper operation & maintenance of building systems to *occupants* and operations staff especially when someone different takes over a building
    - Envelope / Structure / Utilities
    - Flexibility – *for accommodating program and regulatory changes*
    - Expandability / Shrinkability - facilitate changes to the quantity of space
    - Convertibility - allow for changes in use
    - Durability - select materials, assemblies and systems that require less maintenance, repair and replacement.
    - Disassembly - make it easier to take products and assemblies apart so that their constituent elements can more easily be reused or recycled
    - Layering - the goal should be to uncouple those layers of a building that have significantly different lifetimes:
    - Shell – structure, skin
    - Services – plumbing, electrical, circulation
    - Scenery – partitioning, ceilings, finishes
    - Set – furnishings
- Green/healthy housekeeping products will be preferred

- Institute purchasing & discard policies to minimize packaging and waste

- Integrate recycling programs

- Compost organic waste

- Spaces left unoccupied will have a lights out policy

- Provide for the ongoing accountability of building resource consumption over time

- *Utilize the accounting information to inform Operations & Maintenance and design decisions for future projects*

- Reconcile performance with goals

- Provide post occupancy evaluations and implement findings into future projects

- *Integrate a building user liaison to inform the facilities engineering staff*

- Most Challenging Building may happen first

- The State Legislature and the separation of capital costs and operating costs

- Design and Construction Team Selection or Availability

- Not asking why enough

- Educating end users about how their building fits into the whole University

- *Educate and dialogue with State and local Regulatory agencies about*
    - *review and approval*
    - *Procurement*
    - *Incentives*

DRAFT Infrastructure, Energy Generation and Consumption (Summary and Goals)

- Carbon reduction is a focus
- Optimize for "Best of Both Worlds" - advantages of Central Systems were confirmed although it was acknowledged that certain technologies can be more efficiently implemented locally
- Sharing energy amongst buildings, through central systems, represents a key opportunity (Waste = Food)
- Appropriate levels of diversity, reliability, and redundancy need to be established (by building type / building program)
- Combined Heat and Power (CHP) offers many advantages in a single solution and is a well established approach at UNC
- Alternative fuel sources for energy systems represent a significant opportunity for the environmental goals and the economic vitality of North Carolina – offsite production will be considered
- Availability of energy use information is important locally and campus wide likely from a mix of analog-type meters and digital displays – needs reference metric
- Climactic conditions of Chapel Hill suggest the most viable renewable energy technologies are solar based - Naturally occurring wind is not a viable energy source
- Summary of Discussion
- Solar hot water systems may be attractive for their economics, reliability, and ability to be implemented in a distributed nature
- Broad education program will be necessary for various stakeholder groups:
- Building Occupants
- O&M Staff
- General Campus Population
- No technology mandates should be goals (ie 5% energy production via solar)
- More analysis is required to differentiate renewable technologies
- Specific building typology energy consumption targets should be set (ie Energy Budgets)
- Significant land use implications are evident when considering alternative central plant schemes (geothermal bore fields) or renewable energy strategies (PV arrays, biomass production and / or storage)

- **Challenges / Barriers**
- New Ideas and Technologies
- Acceptance
- Reliability
- Operation and Maintenance
- Utility Ownership and Maintenance
- Reliability Expectations
- Funding of Production and Distribution Systems
- Single Source for Procurement of New Technologies
- Shared Utility Corridors – Separation / Easements / Access
- Metering and Billing of Shared Utilities

- **The Path Forward**

- Develop a “Problem Diagram” describing this complex multiple solution set
- Develop a matrix comparison of alternative technologies considering factors such as:
- Cost
- Reliability
- Land use
- Aesthetics
- Carbon
- Operation & Maintenance
- Resource Conservation
- Pedagogical Opportunities
- Health & Wellness
- Offsite / Distribution Requirements
- Phasing
- Other
- Develop a mock CN Program on which to apply sensitivity models – based on load profiles from main campus historical data
- Define draft goals for Metric Workshop

- **Potential Energy Goals**
- Minimize carbon emissions
- Maximize Building Efficiency
- Maximize use of renewable energy
- Centralize utilities where practical
- Recycle energy amongst buildings
- Plan for Combined Heat and Power
- Provide appropriate levels of redundancy and reliability
- Allow for changing technologies in system design
- Provide net energy metering
- Display building energy performance (local and central)
- Provide shared utility corridors
- Educate campus users on energy systems